

REMOTE SENSING EDUCATION AT UNIVERSITY OF TECHNOLOGY MALAYSIA FOR SUPPORTING LOCAL RELATED INDUSTRIES IN ATTAINING SUSTAINABLE NATURAL RESOURCE AND ENVIRONMENTAL MANAGEMENTS

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ABSTRACT

Since the beginning of the remote sensing development, remarkable progress has been made in utilizing remote sensing data, to describe, study, monitor and model the earth's surface and interior. Remote sensing is rapidly becoming accepted as an excellent tool for decision-making process. The present trend of development in remote sensing is focused on the improvements in the sensor technology, especially in the spatial, spectral, and radiometric resolution. These improvements have enabled the scientific community to operationalise the methodology as well as broadening applications of remote sensing data in particular to support sustainable natural resource and environmental managements. The main objective of this paper is to highlight the remote sensing education programmes offered at the University of Technology Malaysia both at undergraduate and postgraduate levels. This programmes is very important as a measure to fulfilled human resource requirements to support the related industries in utilization of the technology for attaining sustainable natural resource and environmental management in Malaysia. The curriculum for the courses, facilities and related research works that have been carried out are also highlighted.

1.0 Introduction

Reviews on historical perspective environmental issues in Malaysia have shown that the concern for environment and sustainability was firmly rooted in the Third Malaysia Plan (1976 – 1980). Set of guideline was established to maintain a healthy environment for human habitation. By the Fifth Malaysia Plan (1986 – 1990), environmental protection had become the main element in most of the development project that have to be carried out for the national progress. Among the many efforts taken in order to sustain both economic growth and environmental were to minimize the impact of human activities such as those related to deforestation, urbanization and tourism, with special emphasized given to prevention through conservation instead of curative measures; and also improve environmental planning in all development projects. *The Environmental Quality Act 1974* that was enacted during this period has also showed the commitment of the Malaysian's government in preventing pollution and degradation of natural resources. The Environmental Impact Assessment was the amended to enable it becoming an important tool to safeguard resources and minimizes the negative consequences of development. This will also ensure that environmental planning become parts of any development projects.

Guided by the Sixth and Seventh Malaysia Plans (1991 – 2000), the last decade was characterized by the concept of balanced development as a major feature of the *National Development Policy*. The primary concern of this development plan were to develop strategies that will generate sustained rapid economic growth as well to ensure that the benefits were equitably shared among all Malaysians. However, considerations have to be taken that apart from economic growth, there was a need to continue and protect the environment and the Malaysia's natural resource base

2.0 Application of Remote Sensing Data for Sustainable Development in Malaysia

The Malaysian Government as stated in the Seventh and Eighth Malaysia Plan has placed a top priority on the operational applications of remote sensing technology. The establishment of the Malaysian Centre for Remote Sensing (MACRES) in 1989, with the main objectives; (i) to develop space remote sensing and related technologies and (ii) to operationalise their applications for resources and environmental management, and strategic planning of the country, have reflected the seriousness on the part of Malaysian Government in making this technology applicable in all aspects of research and development. Since then, many other government organizations such as the Department of Environment, the Klang Valley Planning Unit, the Department of Forestry, the Shah

Alam Municipality, the Petaling Jaya Municipality, the Kuala Lumpur City Council and others have set-up their own Remote Sensing Units. The question now is, whether all those agencies are able to operationalise the application of this technology for their specific purposes.

The common answer is that, despite a very promising development and a very great potential in utilizing remote sensing technique for various kinds of applications, most of the user agencies, which have already set up their own remote sensing units, are still facing problems in the implementation of this technology. Among the most serious problems that have contributed to this slow progress is the lack of skilled personnel. The remote sensing education at UTM therefore can play a very important role in producing skilled personnel to fulfill such need.

3.0 Undergraduate Remote Sensing Programme at UTM

Education in remote sensing and related technologies at the University of Technology Malaysia has its roots from the undergraduate programme in land surveying at the Faculty of Surveying and Real Estate (now called geomatic engineering at the Faculty of Geoinformatic Science & Engineering). Remote sensing has been taught as compulsory subject as well as an optional subject in the course. The postgraduate programmes in remote sensing have been offered since 1988. However, with the increasing importance given to remote sensing in order to fulfill the human resources development needs in the country, a four-year undergraduate programme was formulated and offered in May 1997 at the Faculty leading to B.Sc (Hons.) Remote Sensing degree. Student intake began in May 1997, and now has produced three batches of graduates.

The subjects in the curriculum have been selected to meet the programme objective. Some university subjects are compulsory for undergraduate and postgraduate level in order to meet UTM philosophy to produce competent technologists who are responsible towards the Creator and society.

A total of 138 credits are needed in order to fulfill the requirements to be awarded the Degree of Bachelor of Science (Remote Sensing). Integration of remote sensing with other related technologies/disciplines such as Geographic Information System, photogrammetry and computer science also essential to acquire complete benefits of this technology. List of subjects offered is shown in Appendix 1.

4.0 Postgraduate Programme

The Master Programme is offered in 3 ways, that is Master through taught course, Master through taught course and research, and Master through

research. The total number of credits for the course is 34 with the duration ranging from 1- 2 years. The course work requirements for a Master degree in Remote sensing can be satisfied through the subjects as shown in Appendix 2.

The PhD Programme is a full research programme of 90 credits to be completed in duration of 3-4 years. Master through research and PhD candidates are encouraged to formulate their own research topics to suit their interest or experience.

The entry requirement for the master programme are a relevant Bachelor degree with honours from UTM or any other institutions of higher learning recognised by the Senate, or other relevant qualification equivalent to a Bachelor degree and experience in suitable field recognised by the Senate. While the entry requirement for PhD programme are a relevant Master degree from UTM or any other institution of higher learning recognised by the Senate, or candidates who are currently registered in a relevant Master programme at UTM and have obtained approval from the Graduate Studies Committee and the Senate.

5.0 Laboratory Facilities

The department is equipped with the state-of-the-art facilities and equipment which can be utilized to support undergraduate and postgraduate programmes. Amongst the major facilities available are :

- ❑ **Softwares :** PCI Geomatica (30 licenses), ERDAS Imagine (10 licenses), ENVI (10 licenses), e-Cognition (20 licenses), ESRI ARC/VIEW (10 licenses), WinGIS (10 license), RWEL Desktop Mapping System (30 licenses)
- ❑ **Computers :** Sun 450 Enterprise (1 unit), Sun Blade 2000 (4 units), IBM RISC 6000 (2 units), Pentium based Server (3 units), Pentium 4 PC (60 units). All computers are connected to the internet using Gigabit technology.
- ❑ **Pheripherals:** HP8550N Colour Laser Printer (3 units), HP1000 Large Format Colour Plotter (2 units), HP650 DesignJet Colour Plotter (2 units), Context Large Format Colour Scanner (1 unit), Calcomp Large Format Digitizer (1 unit)
- ❑ **Other facilities :** QUORUM Low Cost Receiving Station (1 system), ASDI Field Spectroradiometer (1 unit low end, 1 unit high end), POM-01L Sky radiometer (1 system), Garmin Handheld GPS (6 units)
- ❑ **Sampling equipments :** Soil moisture meter, Soil PH meter, Water quality measurement system, Scientific electronic oven, Portable wind speed, Portable current meter, Water depth meter.

Other relevant equipments are also available other department in the faculty, i.e. Department of Geomatics Engineering and Department of Geoinformatic.. These include various surveying instruments, geodetic surveying equipments, fotogrammetric facilities, hydrographic surveying facilities and most common GIS software packages.

6.0 CONCLUSION

Applications of remote sensing have increased over the years with better spatial, spectral and radiometric resolutions. These resolutions are/will improve in future which will increase the applications of remote sensing data. It is also acknowledged that the increasing technology user base and expanding areas of space applications call for greater coordination among agencies/institutions that are involved in various fields of space technology application.

The curriculum and syllabus for remote sensing need to be formulated and updated to fulfill current and future development of remote sensing in term of technology and its application. In this paper, the undergraduate and postgraduate programmes in Remote Sensing at University Technology Malaysia have been described. The course structure, curriculum and admissions entrance have also been highlighted. The first batch of the B.Sc (remote sensing) candidates have been graduated in May 2001.

References

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APPENDIX 1

LIST OF SUBJECTS OFFERED FOR B.SC PROGRAMME

YEAR 1 Semester I		Semester II	
UHB1312	Proficiency Skill in English	UHB1322	English for Academic Communication
ULT1112	Asian & Islamic Civilization I	SGS1613	Atmospheric Physics
UHS1142	Asian & Islamic Civilization II	SGS1623	Surveying & Mapping 2
SGS1512	Introduction to Space Science	SGS1633	Remote Sensing Technology I
SGS1523	Surveying & Mapping I	SGS1652	Bio-geography and Geo-chemistry
SGS 1533	Geographical Information System I	SGS1663	Computer Programming I
SGS1542	Oceanography & Physical Geography	UQ1**1	Co-Curriculum I

YEAR 2	Semester I	Semester II	
UHB2332	English for Prof. Communication	SGS2613	Photogrammetry 2
ULT2132	Islamic Institutions	SGS2622	Applied Statistics (Remote Sensing)
UHS2**2	Elective UHS	SGS2633	Remote Sensing for Terrestrial Appl.
SGS2513	Remote Sensing Technology 2	SGS2643	Field Data Collection
SGS2523	Photogrammetry I	SGS2653	Digital Image Processing I
SGS2533	Computer Programming 2	UQ1**1	Co-Curriculum II
SGS2663	Geographical Information System 2	SGS2602	Remote Sensing Camp I (3 weeks HW)

YEAR 3 Semester I		Semester II	
SGS3513	Satellite System & Data Delivery	SGS3612	Satellite Technology & Earth Station
SGS3523	Micro-wave Remote Sensing I	SGS3623	Data Handling, Archiving & Delivery
SGS3533	Digital Image Processing II	SGS3633	Remote Sensing for Atmospheric Appl.
SGS3543	Remote Sensing for Ocean Appl.	SGS3642	Research Method. & Tech. Writing
SGS3502	Remote Sensing Camp (3 weeks HW)	SGS3653	Microwave Remote Sensing II
		SGS3663	Cartography & Digital Mapping
		SGS3606	Industrial Training (10 weeks)
		SGS3602	Industrial Training Seminar

YEAR 4	Semester I	Semester II	
SGS4513	Digital Image Processing III	SGS4613	Remote Sensing Project Management
SGS4523	Spatial Data Analysis	SGS4622	Policy & Legal Aspects of R. Sensing
SGS4532	Undergraduate Project I	SGS4644	Undergraduate Project II
SGS4543	GPS Surveying	SGS46*3	Elective III
SGS45*3	Elective I	SGS46*3	Elective IV
SGS45*3	Elective II		

APPENDIX 2

(A) LIST OF SUBJECTS OFFERED FOR MASTER'S PROGRAMME

By Course only		By Course and Research	
MGS 1014	Principles of remote sensing	MGS 1014	Principles of remote sensing
MGS 1024	Digital image processing	MGS 1024	Digital image processing
MGS 1074	Microwave remote sensing	MGS 1280	Research project
MGS 1084	Field data acquisition & sampling	UHP 6012	Seminar on dev. & global issues
MGS 1996	Master's project	UHW 6022	Social dev. & phil. of science
UHP 6012	Seminar on dev. & global issues		Elective 1
UHW 6022	Social dev. & philosophy of science		Elective 2
Elective Subjects: MGS 1034 Atmospheric physics MGS 1044 Satellite orbits and instrumentation MGS 1054 Principles of GIS MGS 1064 GPS Surveying MGS 1094 Advanced Digital Image Processing MGS 1104 Applications of Remote Sensing			

(B) EXAMPLES OF RELATED RESEARCH WORKS THAT HAVE BEEN CARRIED OUT BY POSTGRADUATE STUDENTS AND ACADEMIC STAFF

NO	RESEARCH AREAS
1	Bathymetry from clear and turbid waters
2	Sea bottom features mapping
3	Suspended sediment concentration studies
4	Vegetation index mapping
5	Sea surface temperature studies
6	Topographic mapping from satellite stereo data
7	Heat island mapping
8	Sea grass and core reef mapping
9	Urban hydrology applications
10	Land use studies
11	Radar remote sensing for land application
12	Digital elevation model generation
13	Software development